HEWLETT PACKARD

Broadband Series Test System

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 3114U. For additional important information about serial numbers, see Chapter 1.

HP E1663A
SONET/SDH Electrical Interface
User's Guide

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Introduction

Introduction

This chapter provides an overview of the HP E1663A SONET/SDH Electrical Interface. It covers:

- a general description of the Electrical Interface, including identification and accessories
- the Control panel
- the front panel indicators and connectors
- the functional features
- safety considerations
- ESD precautions
- service
- storage and shipment

Overview

The HP E1663A SONET/SDH Electrical Interface is a member of the HP Broadband Series of modular VXI-based B-ISDN test instruments. The HP E1663A acts as the interface between the HP Broadband Series Test System and the System Under Test, transmitting and receiving 155.52 Mb/s or 52 Mb/s SONET/SDH transmission signals.

The HP E1663A is used in conjunction with the HP E1697A 155 Mb/s Optical Line Interface or the HP E1617A 52 Mb/s Optical Line Interface, and communication between the modules is by SMA to SMB Radio Frequency (RF) adaptor cables. See “Connecting to an Optical Line Interface”, page 2-4.

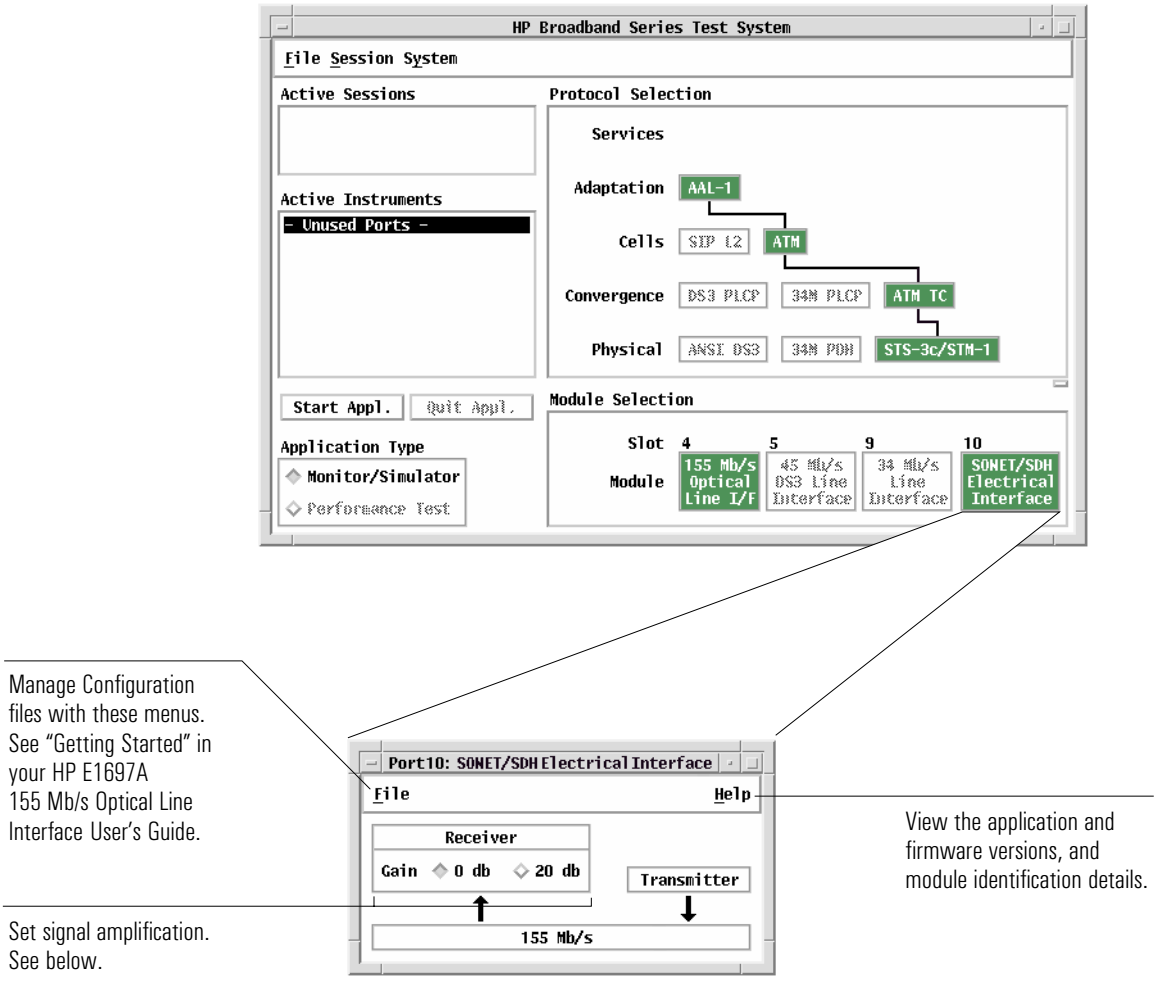
The Electrical Interface provides signal encoding at the appropriate levels and format required by the System Under Test. Data is transmitted in the binary CMI (Coded Mark Inversion) format at 155.52 Mb/s or 52 Mb/s.

The data stream received from the System Under Test is CMI at 155.52 Mb/s or 52 Mb/s. The clock is recovered from the incoming data, and automatic compensation for cable loss and signal loss is provided.

Module Identification

An identification label is attached to the Electrical Interface clamshell enclosure. The serial number is in the form “0000U00000'”. It is in two parts: the first four digits and the letter are the serial prefix, and the last five digits are the suffix. The prefix is the same for all identical modules and changes only when a change is made to the module. The suffix, however, is assigned sequentially and is unique to each module. The contents of this manual apply to instruments with the serial prefix(es) listed under SERIAL NUMBERS on the title page.

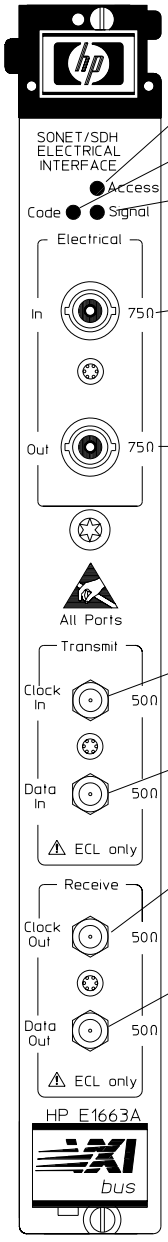
Control Panel at a Glance



Receiver

Setting the 20 dB radio button on directs the received signal through the amplification circuitry which provides a fixed 20 dB gain. When the 0 dB radio button is selected, the received signal is not amplified.

Front Panel at a Glance



INDICATORS

ACCESS
This LED indicates the Electrical Interface is being accessed over the VXIbus backplane.

CODE
This LED is not used in the HP Broadband Series Test System.

SIGNAL
This LED indicates the presence of a signal at the input to the receiver.

LINE CONNECTORS

ELECTRICAL IN
This BNC connector provides a 75 Ω unbalanced data input interface which accepts incoming data for the receiver. The input data rate is 155.52 Mb/s, and the maximum input amplitude is 0.5 V_{pk}. The connector has open and short circuit protection and will withstand a maximum input of ±5 V.

ELECTRICAL OUT
This BNC connector provides a 75 Ω unbalanced data output interface for outgoing coded data. The maximum output amplitude of the CMI coded signal is 0.5 V. The connector has open and short circuit protection and will withstand a maximum input of ±5 V.

INTERMODULE CONNECTORS

TRANSMIT CLOCK IN
This SMA connector accepts the clock input from the HP E1697A. It is an ECL input, and is terminated in 50 Ω to –2 V dc (nominal).

TRANSMIT DATA IN
This SMA connector accepts data, in the binary NRZ format, from the HP E1697A. It is an ECL input, and is terminated in 50 Ω to –2 V dc (nominal).

RECEIVE CLOCK OUT
This SMA connector provides an output for the recovered clock signal for routing to the HP E1697A. It is a low-impedance output giving nominal ECL levels, and requires a 50 Ω to –2 V dc termination.

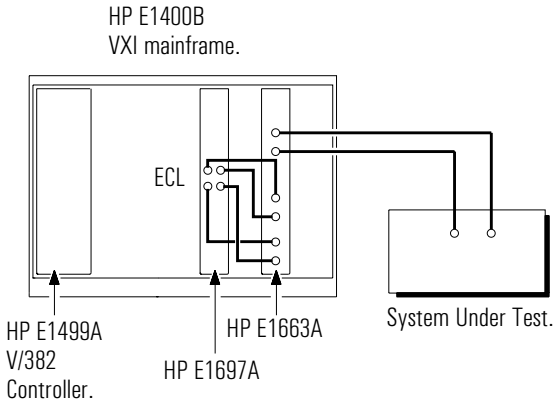
RECEIVE DATA OUT
This SMA connector provides an output for data, in the binary NRZ format, from the receiver for routing to the HP E1697A. It is a low-impedance output giving nominal ECL levels, and requires a 50 Ω to –2 V dc termination.

Functional Features

The Electrical Interface transmits and receives data at the SONET/SDH data rate of 155.52 Mb/s. Communication with the 155 Mb/s Optical Line Interface and the System Under Test is by RF cables fixed to connectors on the front panel.

Figure 1.1 shows a typical system configuration. The System Under Test can be a complete transmission system, or individual system components. See “Connecting to an Optical Line Interface”, page 2-4 and “Connecting to the System Under Test”, page 2-5 for further details.

Figure 1.1 Typical Configuration



Note

See the HP E1697A 155 Mb/s Optical Line Interface User's Guide (HP p/n E1697-90002) for guidance when configuring the 155 Mb/s Optical Line Interface.

Transmitter

The HP E1697A supplies binary NRZ (nonreturn to zero) formatted data signals and associated clock signals to the input of the Electrical Interface. The Electrical Interface then applies CMI encoding to the signal before passing it to the System Under Test.

Receiver

The receiver side of the Electrical Interface provides signal amplification, $\sqrt{f}$ equalization, clock recovery, and CMI decoding at 155.52 Mb/s. The signal is then passed to the HP E1697A for processing.

Monitor Point Access

The signal amplification circuitry provides a fixed 20 dB gain to recover typical monitor point signals. The signal can be switched through the monitor amplifier as required.

Equalization

The equalization circuitry automatically compensates for signal degradation caused by cable loss in the network, and applies the $\sqrt{f}$ law for cables.

Clock Recovery and Decoding

The receiver clock is recovered from the data stream for the subsequent decoding circuitry. Decoding produces data signals in binary NRZ format, and both the clock and regenerated data signals are passed to the HP E1697A for processing.

ESD Precautions

CAUTION

The Electrical Interface contains components sensitive to electrostatic discharge. To prevent component damage, carefully follow the handling precautions presented below.

The smallest static voltage most people can feel is about 3500 volts. It takes less than one tenth of that (about 300 volts) to destroy or severely damage static sensitive circuits. Often, static damage does not immediately cause a malfunction but significantly reduces the component's life. Adhering to the following precautions will reduce the risk of static discharge damage.

- Keep the module in its conductive plastic bag when not installed in the VXI mainframe. Save the bag for future storage of the module.
- Before handling the module, select a work area where potential static sources are minimized. Avoid working in carpeted areas and non-conductive chairs. Keep body movement to a minimum. Hewlett-Packard recommends that you use a controlled static workstation.
- Handle the module by its front panel. Avoid touching any components or edge connectors. When you are ready to configure the module, remove it from its protective bag and lay it on top of the bag while keeping your free hand in contact with the bag. While configuring the module, keep one hand in contact with the bag. This technique maintains your body and the module at the same static potential.
- When you install the module, keep one hand in contact with the protective bag as you pick up the module with your other hand. Then, before installing the module, make contact with the metal surface of the VXI mainframe with your free hand to bring you, the module, and the mainframe to the same static potential. **This also applies whenever you connect/disconnect cables on the front panel.**

CAUTION

The connectors on the front panel remain susceptible to ESD damage while the module is installed in the VXI mainframe, as indicated by the label:

Service

The performance of the Electrical Interface should be verified annually to ensure that it is operating within the specifications. To do this, see the HP *75000 Series 90 HP E1663A SONET/SDH Electrical Interface User's Manual* (HP p/n E1663-90001).

If it is necessary to return the Electrical Interface to Hewlett-Packard for service, ensure the following information is sent with the module:

- Description of the problem (include error messages or specific performance data related to the problem).
- Whether the problem is constant or intermittent.
- Name and phone number of technical contact person.
- Return address.
- Model and option number of returned module.
- Full serial number of returned module.

Exchange Program

This program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.)

The procedure for replacing a faulty Electrical Interface using the assembly-exchange program is as follows:

1 Order the replacement module (HP p/n E1663-69101) through your nearest HP Sales and Service Office.

Note

Do NOT return the faulty module to Hewlett-Packard until you receive the restored-exchange module.

2 Complete the Exchange Failure Report which accompanied the restored-exchange module.

3 Return the faulty module and the Exchange Failure Report to Hewlett-Packard; re-use the special (exchange assembly) carton.

Note

Remove all accessories attached to the Electrical Interface before it enters the assembly-exchange program. Accessories are NOT exchangeable.

Storage and Shipment

The Electrical Interface may be stored or shipped in environments within the following limits:

Temperature : –40°C to +75°C.

Humidity : 50% to 95% RH from 25°C to 40°C.

Altitude : Up to 4600 m (15,000 ft).

The module should also be protected from temperature extremes which may cause condensation within the clamshell enclosure.

Packaging Requirements

To prevent damage to the module during transit, original shipping or equivalent materials should be used to package the module. Containers and material identical to those used in the factory packaging are available through Hewlett-Packard offices. If the original or equivalent shipping material cannot be obtained, instructions for repackaging with commercially available materials are as follows:

1 Wrap the module in anti-static plastic to reduce the possibility of damage caused by ESD.

2 Use a double walled, corrugated cardboard carton of 90 kg (200 lb) test strength. The carton must be large enough to allow 5 to 8 cm (2 to 3 in) on all sides of the module for packing material, and strong enough to accommodate the weight of the module.

3 Surround the module with 5 to 8 cm (2 to 3 in) of packing material to protect the module and prevent it from moving in the carton.

CAUTION

NEVER use styrene pellets as packaging material. They do not adequately cushion the module, or prevent the module from moving in the carton. They also cause damage by generating static electricity.

If packing foam is not available, the best alternative is S.D.-240 Air Cap from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet with air bubbles. Wrap the module with several layers of pink (anti-static) Air Cap to protect the module, and prevent the module from moving within the carton.

4 Seal the carton with strong, nylon, adhesive tape.

5 Mark the carton “FRAGILE, HANDLE WITH CARE”.

6 Retain copies of all shipping papers.

7 In any correspondence, refer to the module by model number and full serial number.

2

Getting Started

Overview

The following diagrams show you how to set up, and operate the line interface. For details, read the relevant manuals.

Ensure that the module is correctly installed in the mainframe before installing software. Refer to the E1663A Module Installation Guide (E1663-91200) for instructions

Once you have correctly installed the module, software, and online help:

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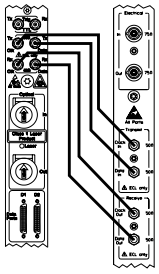
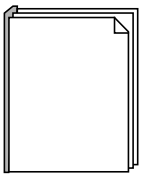
① Connect to an optical line interface.





SONET/SDH Electrical Interface User's Guide.

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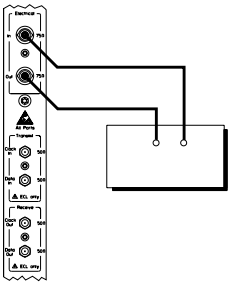
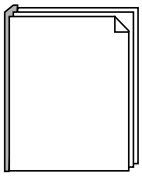
② Connect to the system under test.





SONET/SDH Electrical Interface User's Guide.

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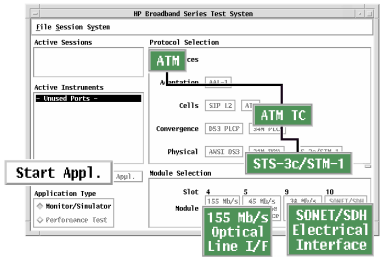
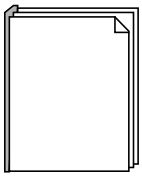
③ Start a test session. Select protocols and modules. If you are testing higher layers, select them now.

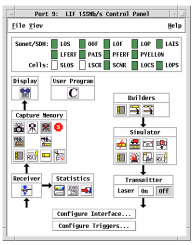
④ Start the application.

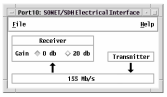


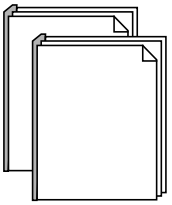


System Installation and Startup Guide.

⑤ Configure the Optical Line Interface and the Electrical Interface for the test session.



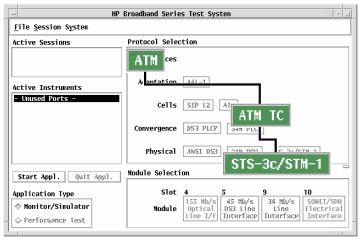


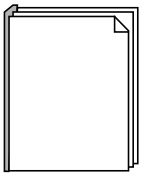


155 Mb/s Optical Line Interface or 52 Mb/s Optical Line Interface User's Guide

SONET/SDH Electrical Interface User's Guide.

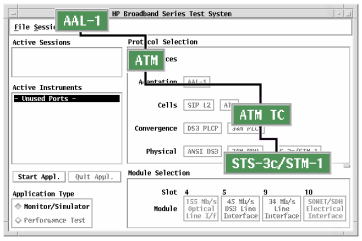
⑥ Test convergence, cell, and physical layers.

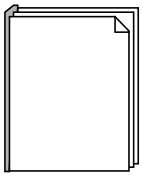




155 Mb/s Optical Line Interface or 52 Mb/s Optical Line Interface User's Guide

Refer to the AAL User's Guide to test higher layer protocols.



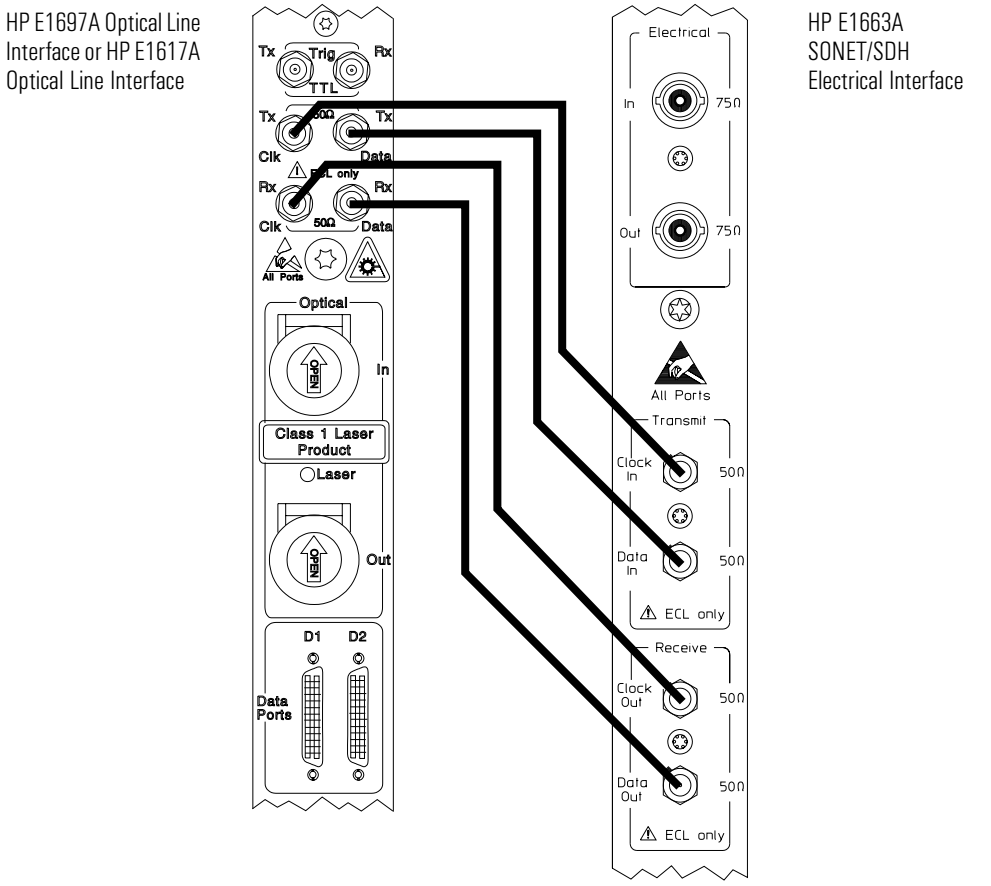


AAL User's Guide.

Connecting to an Optical Line Interface

Before measurements are made, connect the Electrical Interface to the optical line interface module using RF cables with an SMA connector on one end and an SMB connector on the other. Connections are shown in Figure 2.1.

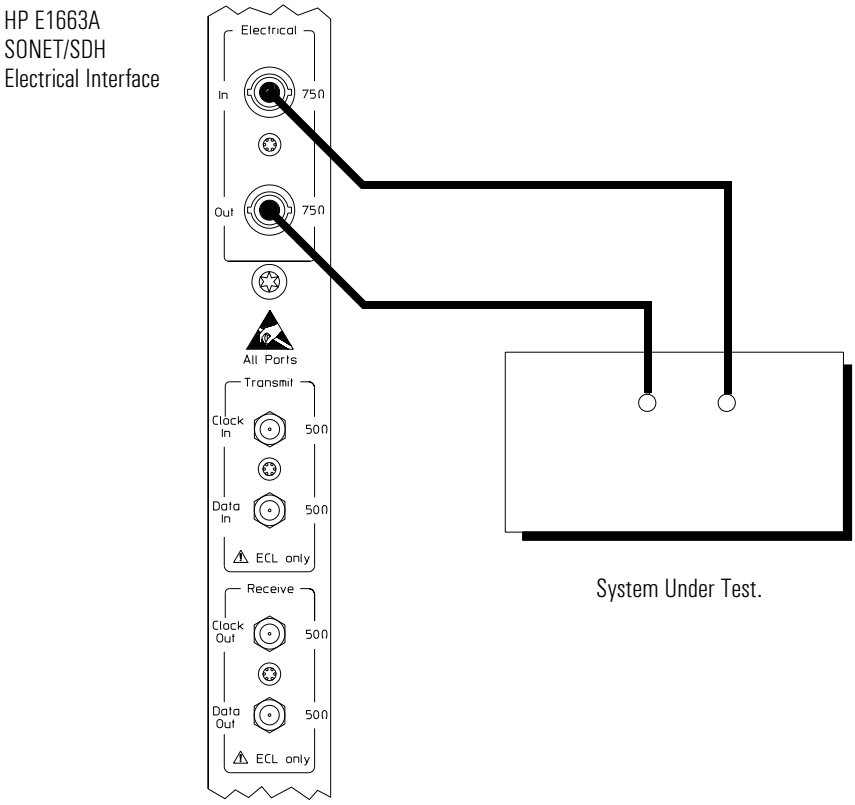
Figure 2.1 **Interconnecting the modules**



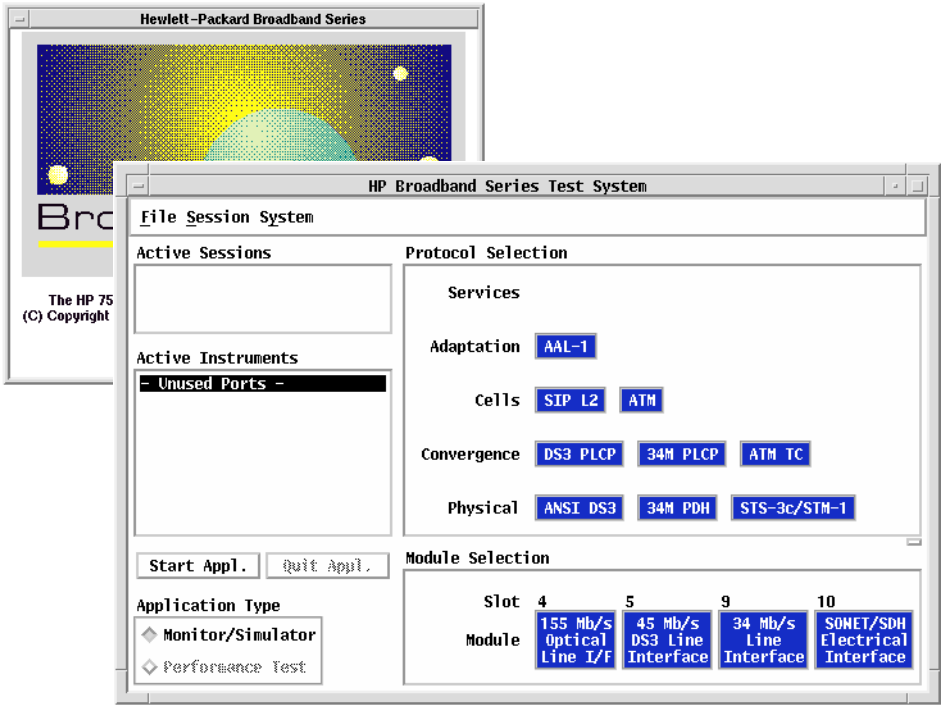
Connecting to the System Under Test

Connect the Electrical Interface to the System Under Test as shown.

Figure 2.2 **Connecting to the system under test**



Starting a Test Session



Log in to the HP Broadband Series Test System

Refer to “Setting Up a Test Session” and “Starting a Test Session” in the *155 Mb/s Optical Line Interface User’s Guide* before logging into the HP Broadband Series Test System.

3

C Function Reference

C Function Reference

The HP E1663A SONET/SDH Electrical Interface cannot be used stand-alone. It must be used in conjunction with an HP E1697A 155 Mb/s Optical Line Interface module.

This chapter describes the Electrical Interface library.

See your *155 Mb/s Optical Line Interface User's Guide* for information on how to write test programs using the HP Broadband Series libraries.

Electrical Interface Library

The SONET/SDH Electrical Interface library, `libeif155.a`, provides functions to control the module. Its header file is `<hpt/eif155.h>`. All Electrical Interface library functions have the prefix HptEif155.

All of these functions returns -1 if an error occurs, 0 otherwise.

Library Initialization

```
int HptEif155InitLib ();
```

Initializes the Electrical Interface library.

Amplifier Gain Setup

```
int HptEif155SetInputGain (int device, int gain);
```

Sets the amplification of the input signal.

Gain parameters:

```
HPT_EIF155_GAIN_0DB             no amplification
HPT_EIF155_GAIN_20DB            set up 20dB amplification
```

4

Specifications

Specifications

Except where otherwise stated, the following parameters are warranted performance specifications. Parameters described as “typical” or “nominal” are supplemental characteristics which provide a useful indication of typical, but non-warranted, performance. All specifications are for 0°C to 55°C after a 30 minute warm-up.

Electrical Specifications

Power Requirements (maximum)

dc Volts	dc Current	Dynamic Current	Power Dissipation
5 V	1.1 A	110 mA	27 Watts
–5.2 V	2.1 A	210 mA	
–2 V	1.3 A	130 mA	
12 V	0.35 A	35 mA	
–12 V	0.32 A	32 mA	

VXIbus Characteristics

Device Type	Register based.
Backplane Connectors	P1, P2
Module Keying	ECL

Coded Electrical Transmitter

Clock	155.52 MHz with 50% ± 10%duty cycle (typical)
Data	Serial stream: 155.52 Mb/s (nominal) The exact transmit bit rate is derived from the binary clock and data input signals
Format	CMI
Output Signals	STS-3 and STM-1
Signal Level	0.5 V_{pk} ± 10%
Return Loss	> 15 dB (7 MHz to 234 MHz)
Impedance	Unbalanced, 75 Ω to ground (nominal)
Protection	Open/short circuit protected
Connector	BNC

Tx Clock and Data

Clock	155.52 MHz with 50% ± 10% duty cycle (typical)
Data	Serial stream: 155.52 Mb/s ± 20 ppm serial
Format	Non-return to zero (NRZ)
Timing	Data set-up time: > 3.9 ns Data hold time: > 1.1 ns
Impedance	50 Ω nominal, terminated to –2 V
Level	ECL
Interface	DC coupled
Connector	SMA

Coded Electrical Receiver

Clock	155.52 MHz with 50% ± 10% duty cycle (typical)
Data	Serial stream: 155.52 Mb/s ± 100 ppm
Format	CMI
Input Signals	STS-3 and STM-1
Equalization	Automatic equalization
Monitor Mode	20 dB of fixed gain to cater for nominal monitor point loss
Return Loss	> 15 dB (7 MHz to 234 MHz)
Impedance	Unbalanced, 75 Ω to ground (nominal)
Protection	Maximum applied voltage ± 5 V short term
Connector	BNC

Rx Clock and Data

Clock	155.52 MHz with 50% ± 10% duty cycle (typical)
Format	Non-return to zero (NRZ)
Timing	Data set-up time: > 600 ps Data hold time: > 3.12 ns
Impedance	50 Ω nominal, terminated to –2 V
Level	ECL
Interface	DC coupled
Connector	SMA

Mechanical Specifications

Physical

Size	One C-size slot
Weight	1.6 kg (nominal)

Environmental Operating Conditions

Operating Temperature	0 to 55 °C.
Storage Temperature	–40 to 75 °C.
Humidity	50% to 95% relative humidity from 25 to 40 °C.

Standards

EMC Regulatory Compliance

FTZ 1046/1984 (CISPR11, EN55011)

Electrical Safety Standards

IEC 348 (1978)
CSA - C22.2 No. 231 Series - M89

Communications Standards

ANSI T1.105-1991, TR-TSY-000253
ITU (CCITT) Recommendations G.703
Bellcore TA-NWT-000253

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